

## **Growth & Characterization of New, Promising Advanced Scintillator Materials**

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The official link for this solicitation is:

[https://www.fbo.gov/download/501/501d0c06272854877d88e1c12194f43c/Amend\\_1\\_SOL.pdf](https://www.fbo.gov/download/501/501d0c06272854877d88e1c12194f43c/Amend_1_SOL.pdf)

Agency:

Department of Homeland Security

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Topic Number:

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Description:

**OBJECTIVE:** Growth and characterization of single crystals of selected new scintillator materials which have been identified, through prior R&D program efforts, as being promising advanced materials with potential of high energy resolution, high efficiency, ease of growth of large size crystals, and low cost. Objective of this effort is to grow large enough crystals to enable characterization of energy resolution and efficiency for large sized crystals, and determine ease of growth for detector-sized crystals and mechanical and chemical ruggedness properties. Crystal compositions are limited to those described below.

**DESCRIPTION:** The Department of Homeland Security Domestic Nuclear Detection Office (DNDO) is involved in discovering, identifying, developing, characterizing, and fabricating new scintillator materials for a variety of application spaces. DNDO has had several programs for several years discovering and investigating new scintillator materials and these programs have now produced lists of new promising candidate materials for crystal growth. Once identified as a promising material, hurdles often remain to actually grow large enough sized crystals to 1) characterize the detection performance via measurement of the absorption characteristics pertinent to gamma and/or neutron radiation, verification of the absorption and transmission characteristics of the scintillating light, measurement of the brightness, determination of the non-linearity, and 2) characterize the growth

potential in order to provide the required absolute efficiency needed for actual radiation detectors. Each material has its own unique challenges to crystal growth. The materials or families of materials which are the subject of this topic area are limited to the following, where ":Eu" indicates Europium doping: Group 1: Ba<sub>2</sub>Cs<sub>1</sub>s:Eu BaCsI):Eu Group 2: BaBrI:Eu BaBrCl:Eu BaClI:Eu The stoichiometry of this latter group (Group 2) can be varied to obtain preferential crystal structure, optimize or minimize trap defects, and improve ease of growth. The Offeror should limit effort to only one or a few of the above candidates to be consistent with period of performance, and should justify choice(s) in proposal. Dopant levels are to be optimized through both the Phase I and Phase II efforts. Proposal should describe approach in detail and justify why the chosen approach would be expected to succeed.

**PHASE I:** Demonstrate the growth of crystals of one or a few of the candidate materials. Demonstrate growth of high quality materials of at least 1 cm<sup>3</sup> volume, and characterize the gamma and or neutron efficiency, as appropriate, the energy resolution as a function of energy, the brightness, the crystal structure and any defects present. High quality is defined as 1) providing energy resolution below 5%, 2) no or few visible defects, such as cracking, chipping, or non-uniformities. Also, characterize the transmission and any self-absorption of the scintillating light, mechanical strength and robustness, and hygroscopicity.

**PHASE II:** Demonstrate the growth of high quality crystals with form factor of 1 "x 1" right cylinders. In addition to Phase II funding, there is an established cost-match program with the opportunity for an additional funding. This cost-match funding mechanism is available for performers that would secure commercialization funding from third parties. See section 4.6 of the solicitation announcement for more information.

**PHASE III:** Commercial Applications - In addition to homeland security applications (U.S. Customs, U.S. Coast Guard), these would be of benefit to the Department of Defense, the Department of Energy, and the International Atomic Energy Agency.